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UPLIFT AND CHEMICAL WEATHERING IN SOUTH-CENTRAL ASIA, THE CARBON CYCLE AND CENOZOIC CLIMATE

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ABSTRACT:

It has been proposed that the general cooling trend through the Cenozoic has been largely due to the enhancement of silicate-rock weathering rates associated with continental uplift in south-central Asia (i.e., the Himalayan and related orogens, and the Tibetan Plateau). One of the primary pieces of evidence cited to support this proposal is the Cenozoic strontium isotope curve, which has been interpreted as indicating progressively increasing silicate-rock weathering rates associated with continental uplift in this region.

Uplift, by increasing the exposed surface area of fresh rock exposed to chemical weathering, may enhance the ease with which rock is weathered, and hence may have an impact on atmospheric CO2 content and climate. However, if this mechanically weathered rock is rapidly transported to and buried in river deltas, enhanced mechanical erosion need not induce enhanced chemical weathering.

Enhanced silicate-rock weathering on a global scale requires an enhanced supply of CO2, else the atmospheric and oceanic reservoirs of CO2 would be rapidly depleted. We have constructed a preliminary carbon budget for the Cenozoic, and have shown that the interpretation of the strontium isotope curve in terms of enhanced chemical weathering rates is inconsistent with both inferred rates of CO2 degassing from the solid Earth and the inferred timing of uplift in Tibet, Himalayas and related orogens. Furthermore, the strontium in rivers draining the Tibetan plateau and the Himalayas is insufficient to account for the observed Cenozoic change in oceanic 87Sr/86Sr ratios.

Furthermore, we have conducted a preliminary field study examining the Himalayan and Karakorum orogens as a potential metamorphic CO2 source to the atmosphere. Our initial results indicate that metamorphic CO2 releases associated with the India-Asia collision would not have been sufficient to supply the CO2 required to account for proposed increases in chemical weathering rates.

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